

# **‘Lisbon’ Lemon Selection Trials in Arizona – 2003-04<sup>1</sup>**

Glenn C. Wright

Department of Plant Sciences, U. of A., Yuma Mesa Agriculture Center, Yuma, AZ

## **Abstract**

*Four ‘Lisbon’ lemon selections, ‘Frost Nucellar’, ‘Corona Foothills’, ‘Limoneira 8A’ and ‘Prior’ were selected for evaluation on Citrus volkameriana rootstock. 2003-04 results indicate that the ‘Limoneira 8A Lisbon’ and ‘Corona Foothills Lisbon’ are superior in yield and fruit size. Results for 2002-03 indicate that these cultivars as well as ‘Frost Nucellar’ have superior yield.*

## **Introduction**

There is no disputing the importance of citrus scion cultivar selections to desert citrus production. A successful citrus cultivar must be adaptable to the harsh climate, (where average high temperatures are often greater than 40°C), must be vigorous and must produce high yields of good quality fruit of marketable size.

Lemons are the most important and profitable citrus cultivar grown in Arizona today. Today, lemons comprise 60% of all harvested citrus acreage in the state. When the lemon industry was established in the 1950’s the principal variety was the ‘Desert Lisbon’. No records exist as to the characteristics of this variety. Within a few years however, ‘Desert Lisbon’ was eclipsed in popularity by ‘Frost Nucellar Lisbon’ the only nucellar clonal selection of the ‘Lisbon’ variety. Other popular clonal selections of ‘Lisbon’ that have been planted in Arizona include ‘Monroe’, ‘Limoneira 8A’, ‘Corona Foothills (also known as Foothills)’, ‘Prior’, and ‘Rosenberger’. All of these represent selections of outstanding trees that were then propagated. All are identified by their originator or place of origin, and are characterized by high vigor, high productivity, precocity (trees bear at an early age), earliness (a high percentage of the fruit can be harvested before 15 November), short thorns and good fruit quality. However, there is a certain amount of variability among ‘Lisbon’ clonal selections.

As the Arizona lemon industry has found itself a marketing niche for the late summer and early fall harvest, high productivity, good fruit quality and earliness have become increasingly important. Selections that have not met these standards have been superseded by selections that have these characteristics. Consequently, by 1992, the most popular clonal lemon selection grown in Arizona was the ‘Limoneira 8A Lisbon’. This selection originated in Santa Paula, CA, exhibits high productivity, precocity, earliness, and has adequate fruit quality. Other ‘Lisbon’ selections still grown in Arizona include ‘Prior’ and ‘Frost Nucellar’. ‘Corona Foothills’ is a more recent introduction that originates in Corona, CA. Not much is known about this selection, other than it has a reputation for high productivity. Therefore, we planted the first ‘Lisbon’ lemon selection trial in 1993 including ‘Limoneira 8A Lisbon’, ‘Prior Lisbon’, ‘Frost Nucellar Lisbon’, and ‘Corona Foothills Lisbon’ lemon on *C. volkameriana* as the rootstock. . Previous results from this trial have been reported in previous issues of the Citrus Research Report

---

<sup>1</sup> The author wishes to thank Mr. Phillip Tilt, Mr. Marco Peña, Mr. Arturo Moreno, and the Yuma Mesa Fruit Grower’s Association for their assistance in completing this project. The author would also like to thank the Arizona Citrus Research Council for supporting this research. This is a partial final report for project 2003-06 – Citrus rootstock and cultivar breeding and evaluation for the Arizona citrus industry – 2003-04.

## Materials and Methods

This trial was established in March 1993 in Block 26 of the Yuma Mesa Agricultural Center, near Yuma, Arizona. The land was laser leveled and fumigated prior to planting. Trees were planted on a 10-m x 10-m spacing. Ten replicates of each of the 5 rootstocks were planted for a total of 50 trees. Experimental design is randomized complete block.

Irrigation is border flood, and normal cultural practices are used. Leaves are collected annually in August for mineral analysis; however there have been no significant differences in leaf nutrient content. Yield data is collected during the fall and winter. Trees were ring or strip-picked. For 2003-04, trees were ring picked on 11-7-03 and strip-picked on 2-16-04. For each harvest date, the entire quantity of harvested fruit from each tree was passed through an automated electronic eye sorter (Autoline, Inc., Reedley, CA), which provides weight, color, exterior quality and size data for each fruit. Fruit packout data is reported on a percentage basis. Fruit grade data was not collected in 2003-04 due to a machine malfunction. Fruit quality data was collected at each harvest time. These data include °brix, peel thickness, percentage juice, pH, and total soluble solids to total acid ratio. There was no effect of rootstock on fruit quality (data not shown).

All data was analyzed using SPSS 11.0 for Windows (SPSS Inc., Chicago, Illinois).

## Results

Yields for this experiment, since the trees have been bearing, are shown in Figure 1. There have been no consistent trends, however significant differences were found in 1998-99 when 'Limoneira 8A' and 'Corona Foothills', were superior, in 2000-2001 when 'Frost Nucellar' had less yield than the others, in 2002-03 when 'Prior' had less yield than the other selections, and in 2003-04 when 'Corona Foothills' had less yield than the others. Counting only the six years since 1998-99, when yields of these trees surpassed 100 lbs per tree, 'Limoneira 8A' has ranked first or second in annual yields 5 times, Corona Foothills has ranked first or second five times, 'Frost Nucellar' has ranked first or second 2 times (in 2002 -03, and 2003-04), and 'Prior' has ranked first or second only once.

Yields for the two harvests of the 2003-04 season are shown in Figure 2. For the 11-7-03 harvest, there was no difference in yields of trees on the four rootstocks. For the 2-16-04 harvest, yields of 'Limoneira 8A' and 'Frost Nucellar' were significantly greater than the other two selections; this contributed to the overall difference for the annual yields.

Packout for the first harvest is shown in Figure 3. 'Corona Foothills' and 'Prior' had the more fruit of size 75 and 95, while 'Frost Nucellar' had more fruit of size 165. 'Limoneira 8A' was intermediate. For the second harvest, there were significant differences only for sizes 75, 115 and 140. Again, 'Corona Foothills' had more fruit of size 75, and fewer of size 115 and 140, while 'Prior' had fewer of size 75, and more of size 115 and 140.

There was no difference in fruit shape between the selections, but 'Corona Foothills' had significantly less round fruit than the others, irrespective of harvest

## Discussion and Conclusions

For the scions, both 'Limoneira 8A' and 'Corona Foothills' still appear to be superior to the other selections tested. Yields for 'Limoneira 8A' were the greatest for the first eight years of this ten-year study. Additionally, fruit size was generally larger for this selection, particularly in the first harvest, compared to the other selections tested. While for 2001-02 and 2002-03, 'Limoneira 8A' did not have the greatest yield, for 2003-04, it regained the top spot. Cumulative yield for the 'Limoneira 8A' since planting is 2550 lbs per tree; the greatest 10-year cumulative yield for all the selections in this trial. Whether 'Limoneira 8A' will remain superior is still not known. Nonetheless, this scion is still the industry standard, and is recommended for planting.

Yield of 'Corona Foothills' has equaled or surpassed 'Limoneira 8A' for three of the past four years, but this is the first year that it had lower yield than all the others. Fruit size for this selection seems to be superior to all others. However for five of the first six years of this trial, this selection was inferior to 'Limoneira 8A'. This early inferiority is reflected in the cumulative yield for 'Corona Foothills' of 2300 lbs per tree; about 10% less than 'Limoneira 8A'. Based on its recent performance, this scion is still recommended for planting.

'Frost Nucellar Lisbon' performed well in 2002-03 and 2003-04; the first two years in which it has done so. Before the last two seasons, this selection has typically had lower, although not always significantly lower, yield than the other selections tested. Cumulative yield for 'Frost Nucellar' since the inception of this experiment is only 2175 lbs. per tree, about 15% less than 'Limoneira 8A'. Fruit size for 'Frost Nucellar' is typically smaller than 'Corona Foothills' or for 'Limoneira 8A'. It remains to be seen if the superior yield this season is a one-time phenomena or an indication of permanent improvement.

After two seasons of superior performance in 2000-01 and in 2001-02, yield of 'Prior Lisbon' was significantly lower in 2002-03, and 2003-04. This marks a return to its lower performance typical of 1994 through 2000. Cumulative yield for this selection since the start of the experiment is 2045 lbs. per tree, about 20% less than 'Limoneira 8A'. While fruit size was good for this selection, the lower yield cannot be discounted.

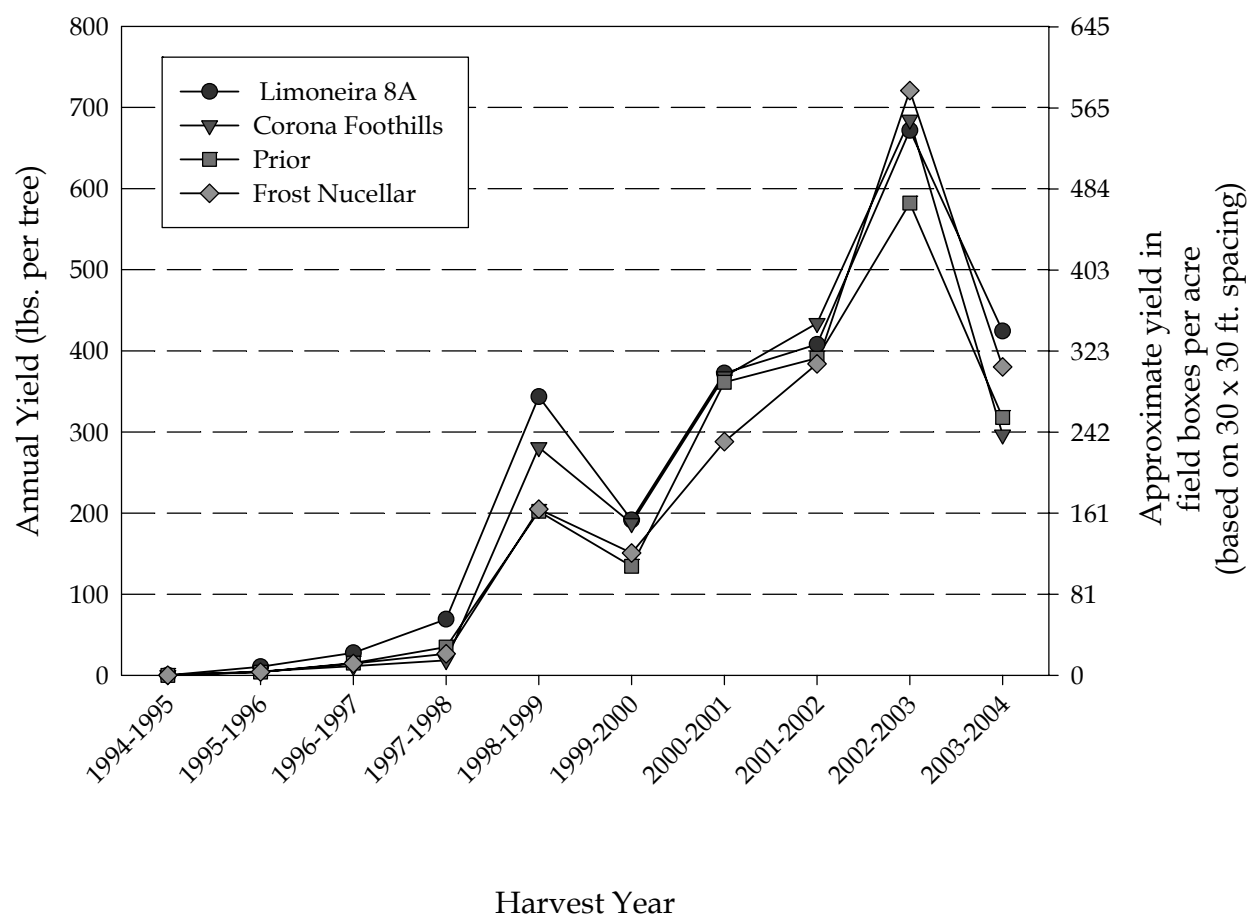


Figure 1. Yields of four 'Lisbon' lemon selections on *C. volkameriana* rootstock.

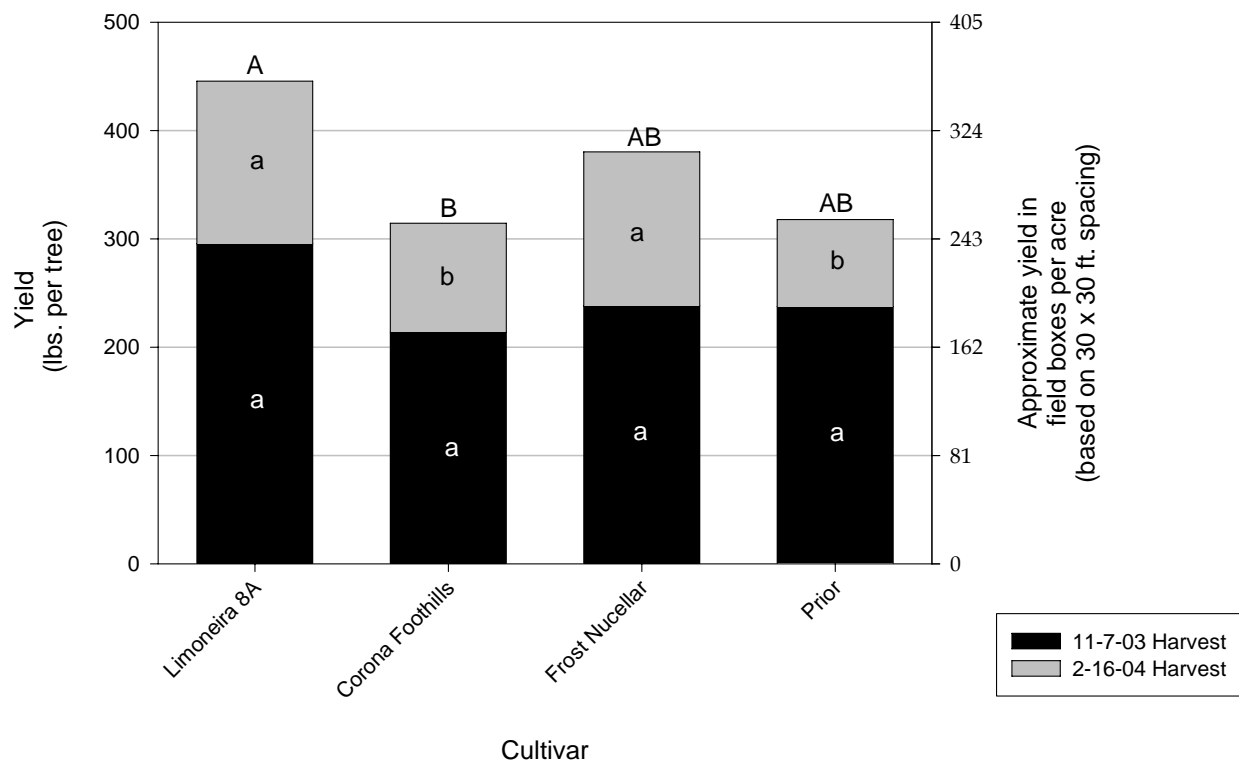


Figure 2. Yields of four 'Lisbon' lemons on *C. volkameriana* rootstocks for 2003-04, separated by harvest time. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared. Overall yield for the year can be compared using the uppercase letters above each stacked bar.

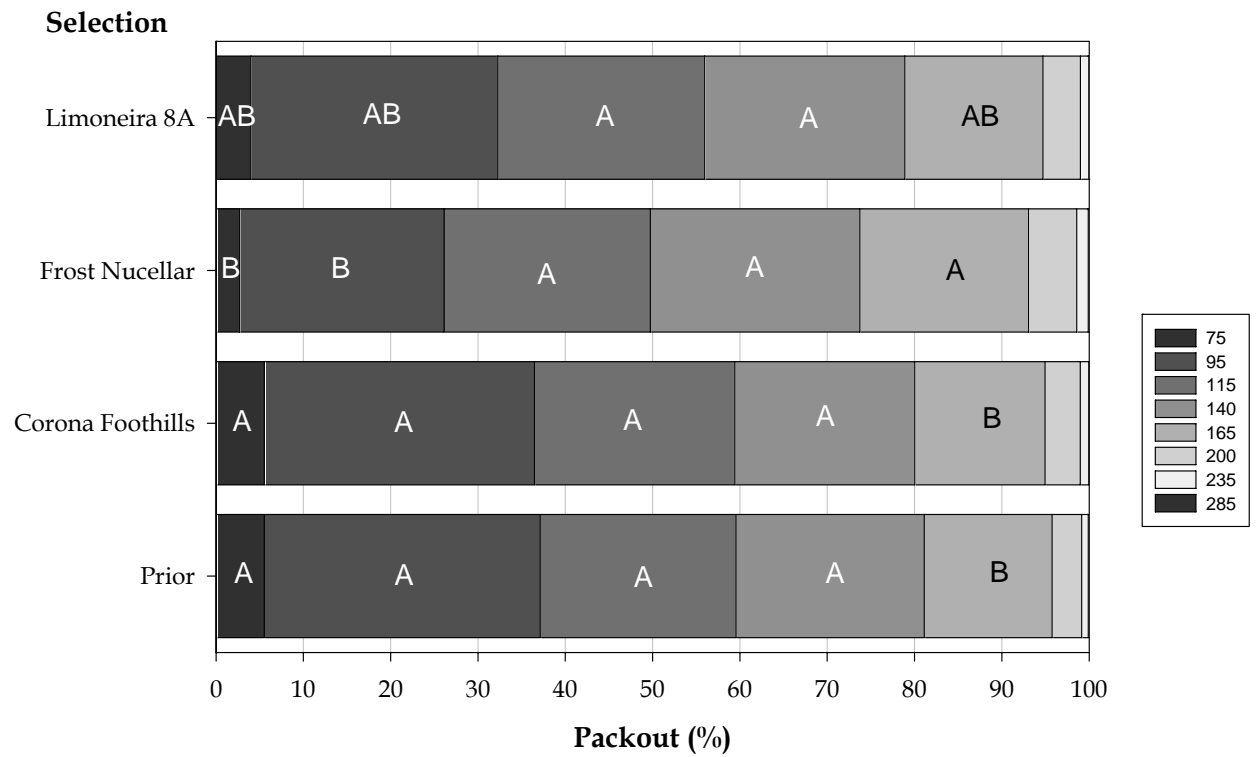


Figure 3. Packout of four 'Lisbon' lemon selections on *C. volkameriana* rootstock for the 11-7-03 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.

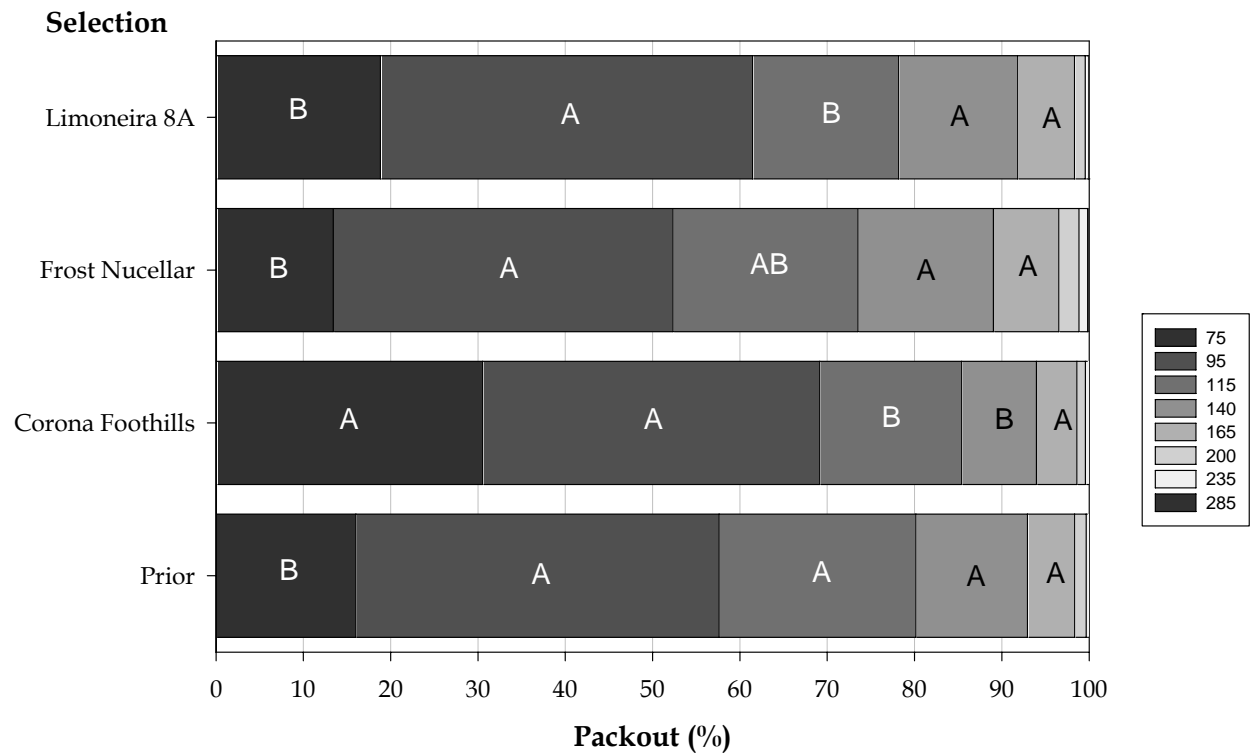


Figure 4. Packout of four 'Lisbon' lemon selections on *C. volkameriana* rootstock for the 2-16-04 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.

Table 1. Fruit shape and color of four 'Lisbon' lemon selections budded to *C. volkameriana* rootstock. For fruit shape, a larger number indicates a more round fruit. For color, a larger number indicates a greater degree of redness.

Selection <sup>z</sup>	11-7-03 Harvest		2-16-04 Harvest	
	Fruit Shape	Fruit Color	Fruit Shape	Fruit Color
Limoneira 8A	0.780 ab <sup>y</sup>	1.012 a	0.796 a	1.402 a
Frost Nucellar	0.799 a	0.976 a	0.810 a	1.389 a
Corona Foothills	0.761 b	1.000 a	0.767 b	1.385 a
Prior	0.788 ab	1.004 a	0.806 a	1.400 a

<sup>z</sup> Values are the means of 10 trees.

<sup>y</sup> Means separation in columns by Duncan's Multiple Range Test, 5% level.